

REMARKS

Claims 1-44 were presented for examination.

Claims 1-7, 9, 16-30, 33-35, 38-42 and 44 were rejected.

Claims 8, 10-15, 31, 32, 36, 37 and 43 were objected to.

Applicant is hereby amending all of the independent claims 1, 16, 29, 34, 38 and 42; amending dependent claims 24, 30 and 31; and cancelling claim 23; merely to distinctly claim its invention.

Reconsideration of this application as amended, and allowance of all pending claims, claims 1-22 and 24-44 as amended, are hereby respectfully requested.

Claims 23, 24 and 30: Under 35 U.S.C. § 112, second paragraph

Claims 23, 24 and 30 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Claim 23 was rejected as lacking antecedent basis for “the optical-to-electrical converter.” Applicant has cancelled claim 23 and amended sub-dependent claim 24 to depend from claim 17, which recites an “optical-to-electrical converter.”

Claims 23 and 30 were rejected as not defining how the “defocused pupil images” were generated. Applicant has cancelled claim 23 and amended sub-dependent claim 24 and amended claims 30 and 31 to recite a vibrating mirror that introduces a defocus in the pupil images.

Applicant submits that these claims as amended now define the invention with sufficient particularity and distinctiveness to be patentable to Applicant and requests that the rejections be withdrawn.

Claims 1-22, 24-44: Dimmler may encode wavefront information onto an optical beam, but Dimmler does not sense wavefront information from the wavefront of the optical beam.

All independent claims 1, 16, 29, 34, 38 and 42 and some of the dependent claims were rejected either under 35 U.S.C. § 102 and/or 35 U.S.C. § 103 in light of Dimmler (Pub. No. US 2003/0067657) sometimes in combination with various secondary references (Devon and Hirohashi).

Claim 1 and all of the independent claims recite a situation in which an optical beam encoded with data is converted from optical to electrical form, and this conversion results in an electrical signal that contains the data but also senses information about the wavefront of the optical beam. In contrast, in Dimmler, information about the wavefront is sensed somewhere else and is included as part of the data encoded on an optical beam. When the optical beam is converted to electrical form, the electrical signal contains the encoded data, some of which is data about an optical wavefront.

Although not required, Applicant is amending independent claim 1 and the other independent claims to more expressly recite this distinction. Claim 1 now recites a device for wavefront sensing and data detection which includes:

an optical-to-electrical converter for receiving an optical beam encoded with data and converting the optical beam to an intermediate electrical signal, the intermediate electrical signal containing the data and further containing wavefront information sensed from a wavefront of the optical beam by the optical-to-electrical converter (emphasis added)

As currently drafted, claim 1 requires that the resulting intermediate electrical signal must contain both (1) data (which was encoded on the optical beam) and (2) wavefront information sensed from a wavefront of the optical beam by the optical-to-electrical converter. In other

words, the optical-to-electrical converter functions both to recover data from the optical beam and to sense the wavefront of the optical beam. Claim 16 expressly recites a combined wavefront/data sensor with similar limitations.

One benefit of combining wavefront sensing and data detection is a simple and robust configuration. The number of detectors typically is reduced and there is no requirement to register separate wavefront and data detectors. Another advantage becomes apparent under severe turbulence conditions, where multiple optical paths may contribute to light in the telescope pupil. This can lead to several “mirage” images in the image plane. Mirage images can lead to loss of coupling to a single mode fiber, either due to the adaptive optics module guiding to a mid-position between two “mirage” images, or due to the transfer of energy from one mirage image to another, causing the adaptive optics module to snap between images. While mirage image can cause dropouts when coupling to a single mode fiber, the light level in the pupil is largely unaffected. Thus the combined wavefront sensor and data detector typically will give more robust performance under severe turbulence conditions.

Neither Dimmler nor any of the other references teach or suggest a combined wavefront sensor and data detector. The Office Action points to Dimmler’s communication receiver 68 as the element that corresponds to claim 1’s “optical-to-electrical converter.” However, this is not the case. As explained by Dimmler, “[c]ommunication receiver 68 extracts the embedded data from laser beam 64 using a known method and transfers the information to the appropriate communication system components. In a preferred embodiment of the present invention, beam 64 will not only carry communication data, but will also carry wavefront and pointing and tracking information.” [paragraph 0027].

Thus, the wavefront information recovered by Dimmler's communication receiver is not sensed by the communication receiver itself. Rather, it is sensed elsewhere and then encoded onto the incoming optical beam as data. Dimmler's communication receiver simply recovers this data, the same as the other communication data encoded on the optical beam. Accordingly, this information is not "sensed from a wavefront of the optical beam by the optical-to-electrical converter," as recited in claim 1. Nor do any of the other references cure this fundamental defect in Dimmler.

Hence, Applicant respectfully submits that claim 1 is patentably distinctive from the cited art on this independent ground. Furthermore, Applicant further submits that the remaining independent claims 16, 29, 34, 38 and 42 are also patentably distinctive for the same reason.

Claims 8, 10-15, 24, 31, 32, 36, 37 and 43: Rights reserved.

Claims 8, 10-15, 24, 31, 32, 36, 37 and 43 were objected to but allowable if rewritten in independent form. For economy of prosecution, Applicant has not done so in this response but reserves the right to do so in the future in order to put these claims in condition for allowance.

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Closing

Applicant believes that the application is in condition for allowance of all claims herein, claims 1-22 and 24-44 as amended, and therefore an early Notice of Allowance is respectfully requested. If the Examiner believes that for any reason direct contact with Applicant's attorney would help advance the prosecution of this case to finality, the Examiner is invited to telephone the undersigned at the number given below.

Respectfully submitted,

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